

AMENDMENTS TO THE CLAIMS

The claims in this listing will replace all prior versions, and listings, of claims in the application.

1. (Original) A step-zoom lens which changes a variable focal length thereof stepwise, comprising:

two movable lens groups;

a lens group support unit which supports said two movable lens groups, said lens group support unit being linearly guided along an optical axis to perform zooming and focusing operations, wherein a distance between said two movable lens groups is changed, in said lens group support unit, between a first distance in a wide-angle range which ranges from a short focal length extremity to an intermediate focal length, and a second distance in a telephoto range which ranges from said intermediate focal length to a long focal length extremity; and

a cam ring having at least one cam groove, a rotation of said cam ring causing said lens group support unit to move linearly along said optical axis according to said cam groove;

wherein said cam groove comprises a finite number of focal-length steps for each of said wide-angle range and said telephoto range, said focal-length steps being determined so as to follow a reference cam diagram for moving said two movable lens groups to perform said zooming operation when focused at infinity, said cam groove being determined to perform said focusing operation between an infinite photographing position and a closest photographing position at each of said focal-length steps by rotation of said cam ring;

wherein said cam groove comprises a wide-angle mode section for defining said wide-angle range, a telephoto mode section for defining said telephoto range, and a mode switching section for switching between said wide-angle mode section and said telephoto mode section;

wherein said closest photographing positions in two adjacent said focal-length steps are adjacent to each other, and said infinite photographing positions in two adjacent said focal-length steps are adjacent to each other; and

wherein one of said focal-length steps of said infinite photographing position at a longest focal length in said wide-angle mode section is provided at one end of said mode switching section, and another of said focal-length steps of said infinite photographing position at a shortest focal length in said telephoto mode section is provided at the other end of said mode switching section.

2. (Original) The step-zoom lens according to claim 1, further comprising:

a linear guide ring which is movable together with said cam ring along said optical axis, wherein relative rotation is allowed between said linear guide ring and said cam ring;

a switching member which is supported by said linear guide ring to be freely movable forward and reverse in a circumferential direction of said linear guide ring within a predetermined angle of rotation with respect to said linear guide ring in association with rotation of said cam ring at said intermediate focal length;

a switching member moving mechanism for moving said switching member forward and reverse at said intermediate focal length in association with rotation of said cam ring;

a distance changing mechanism for changing said distance between said two movable lens groups between said first distance and said second distance in association with forward and reverse rotations of the switching member at forward and reverse rotating limits thereof, respectively.

3. (Original) The step-zoom lens according to claim 2, wherein said switching member moving mechanism comprises:

a switching ring which rotates together with said cam ring;

a groove which is formed on an inner peripheral surface of said switching ring;  
and

a projection which projects from said switching member to be engaged in said switching groove.

4. (Original) The step-zoom lens according to claim 2, wherein said distance changing mechanism comprises:

a differential ring which rotates together with said switching member;

a rotating lens frame which supports one of said two movable lens groups, and rotates without moving along said optical axis by a rotation of said differential ring; and

a linear-moving lens frame which supports the other of said two movable lens groups, and linearly moves along said optical axis by a rotation of said rotating lens frame.

5. (Original) The step-zoom lens according to claim 2, wherein said step-zoom lens system comprises at least four movable lens groups, said two movable lens groups being positioned between a frontmost lens group and a rearmost lens group of said four movable lens groups.

6. (Original) The step-zoom lens according to claim 2, wherein said linear guide ring comprises a guide slot in which said switching member is positioned so that an outer peripheral surface of said switching member is substantially flush with an outer peripheral surface of said linear guide ring.

7. (Original) The step-zoom lens according to claim 4, wherein said switching member comprises a straight groove which is formed on an inner peripheral surface of said switching member to extend parallel to said optical axis, and

wherein said differential ring comprises a projection which projects radially outwards to be engaged in said straight groove.

8. (Original) The step-zoom lens according to claim 4, wherein said step-zoom lens comprises a shutter unit which is fixed to said lens group support unit.

9. (Original) The step-zoom lens according to claim 1, wherein said first distance is wider than said second distance.

10. (Original) The step-zoom lens according to claim 1, wherein said step-zoom lens is of a telescoping type step-zoom lens having a plurality of telescoping barrels.

11. (New) A zoom lens comprising:

two movable lens groups;

a lens group support unit which supports said two movable lens groups, said lens group support unit being linearly guided along an optical axis to perform zooming and focusing operations;

a cam ring having at least one cam groove, rotation of said cam ring causing said lens group support unit to move linearly along said optical axis according to a shape of said cam groove;

wherein said cam groove comprises a finite number of focal-length steps, said focal-length steps being determined so as to follow a reference cam diagram for moving said two movable lens groups to perform said zooming operation when focused at infinity, said cam groove being configured to perform said focusing operation between an infinite photographing position and a closest photographing position at each of said focal-length steps by rotation of said cam ring; and

wherein said closest photographing positions in two adjacent said focal-length steps are adjacent to each other, and said infinite photographing positions in two adjacent said focal-length steps are adjacent to each other.

12. (New) The zoom lens according to claim 11, wherein said zoom lens system comprises at least four movable lens groups, said two movable lens groups being positioned between a frontmost lens group and a rearmost lens group of said four movable lens groups.

13. (New) The zoom lens according to claim 11, wherein said zoom lens comprises a shutter unit which is fixed to said lens group support unit.

14. (New) The zoom lens according to claim 11, wherein said zoom lens is of a telescoping type zoom lens having a plurality of telescoping barrels.